

THE BEST METHOD OF COLLECTING THE URINE FROM THE URETERS FOR DIAGNOSTIC PURPOSES.¹

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ALTHOUGH numerous methods and devices have been invented during the past few years for collecting the urines directly from each kidney separately, they may practically all be discarded to-day with the exception of two. These are the ureteral catheter and the urine segregator. The former of these is a direct outgrowth of the cystoscope, an instrument which has furnished such valuable information in the diagnosis of conditions of the urinary tract. To see the ureteral opening at once inspired the thought to introduce the ureteral catheter, and inventive ingenuity soon provided the way for the fulfillment of this desire. The segregator takes advantage of the anatomic fact of the separateness of the ureters as they enter the bladder, and by mechanically prolonging them to the exterior of the body segregates the urines into separate vials.

Because these two methods are so radically different, it does not necessarily follow that they are antagonistic, or that the one must displace the other. It is quite possible that each may have distinct advantages, thereby rendering it specially applicable to particular conditions, and it will therefore be proper to inquire into the merits and demerits, the advantages and disadvantages of each. In dealing with catheterization of the ureters no attempt will be made to define the advantages claimed for any particular instrument, as, for instance, Nitze's,

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Casper's, Bremner's, or Albarran's, or the Kelly method, but the principle of catheterization alone will be considered. Intimately associated with the use of the ureteral catheter for drawing off the urine is the use of solid ureteral bougies or sounds. However, the use of ureteral bougies or sounds, either for diagnostic purposes or as an aid in certain operations, does not properly come under the subject for discussion.

That information of great diagnostic value may be obtained by collecting the urines directly from the kidneys no one will deny who is familiar with diseases of the urinary tract; however, the simplest, most reliable, and least harmful method of accomplishing this end is a subject well open to discussion.

In considering catheterization of the ureters it is found that certain conditions in the patient are essential in order that the procedure may be successfully practised. The first of these conditions is an unobstructed urethra of sufficient size to permit the introduction of the instrument; second, the bladder must have a capacity and tolerance for 120 to 150 cubic centimetres of fluid; third, the fluid must remain transparent a sufficient length of time to permit the catheter to be introduced. These conditions apply equally to all uretero-cystoscopes. To the Kelly method, however, which is practical only in the female, conditions two and three do not apply. Condition one is so self-evident that it requires no comment.

The capacity and tolerance of the bladder or condition number two may vary greatly, particularly when this viscus is the seat of inflammatory changes. In chronic cystitis the bladder may be so contracted that sufficient fluid cannot be introduced to permit the necessary manipulations of the instrument, or the irritability may be so great that the organ will not tolerate the fluid. In the latter case, the intolerance may be overcome by anaesthesia, local or general.

As the catheter is introduced into the ureteral opening by the sense of sight, it is evident that the media must be transparent enough to permit the passage of sufficient light for distinct vision. The transparency of the fluid is most frequently interfered with by blood and pus. The bleeding may come

from the bladder wall or the kidney, and may be so profuse as to cloud the fluid before the ureteral opening can be found and the catheter introduced. An irrigating instrument, by which the fluid can constantly be changed, will do much to overcome this obstacle. Even when the three essential conditions are present, there may still be intravesical obstacles to the introduction of the catheter. Thus, Willy Meyer says (*Medical Record*, 1898, Vol. li, p. 613) "the method may prove unsuccessful owing to the fact that the mouths of the ureters cannot be found, or that they cannot be approached, or that they are too small to allow the entrance of even the finest of catheters."

Extravesical conditions, such as displacements or tumors of the uterus, may so distort the base of the bladder as to render the introduction of the catheter impossible. I saw one of the most expert ureteral catheterizers of Europe fail owing to the presence of a medium-sized myoma of the uterus. Even when the end of the catheter engages properly within the ureteral orifice, it may be impossible to introduce it any distance, and Albarran says (*Traite de Chir. Clinique et Operative*, 1899, Vol. viii, p. 616) "in certain patients no skill will succeed." Israel (*Verhandlung der Berliner medicinische Gesellschaft*, 1899, S. 16) mentions a case in which Casper, after repeated trials, failed to introduce the catheter but a few centimetres, although the autopsy showed the ureter free and able to receive a sound throughout much larger than had been used by Casper.

After the catheter has been successfully introduced a sufficient distance, the urine may still fail to flow, as the eye of the catheter may become occluded by thickened pus picked up in the bladder or met with in the ureter, or by blood-clot, the result of hæmorrhage excited by the introduction of the instrument, or by blood or pus descending from the kidney. Casper (*British Medical Journal*, 1898, Vol. ii, p. 1412) says the introduction of the catheter may provoke spasm of the ureter with complete oliguria, not a drop of urine flowing through the catheter. The ureter may fold over the end of the

catheter and obstruct the flow as mentioned by Albarran. These are some of the obstacles that have interfered with the success of the method in the hands of the most expert ureteral catheterizers, while, in the hands of the ordinary one, the failures, through lack of dexterity and sufficient training, are very numerous. That the percentage of failures, even in the hands of experts, is comparatively large is shown by the very instructive report of F. Tilden Brown (*ANNALS OF SURGERY*, 1899, Vol. xxx, p. 661). He says, "Of the fifty-five cases there were two males where the conditions were such that no attempt was made to pass urine collecting instruments. In eight other cases (five males and three females) the attempt to collect separate urines failed completely." Excluding the two untried cases, we have eight failures in fifty-three cases, or 15 per cent.

Turning now from the mechanical part or introduction to the results, we find here other sources of inaccuracy. While theoretically ureteral catheterization should give a perfect sample of the kidney's work, practically this is not always true. A certain amount of blood in the urine collected is the rule. Holscher says (*Münchener medizinische Wochenschrift*, 1897, Vol. xlv, p. 1431), "Blood almost always appears in the urine, due to injury to the ureter." Casper says (*British Medical Journal*, 1898, Vol. xi, p. 1412), "A slight mechanical lesion cannot occasionally be avoided," and "Very slight bleeding may occasionally be observed." Again he says (Hollander, *Berliner klinische Wochenschrift*, 1897, Vol. xxxiv, p. 740), "In 50 per cent. of healthy cases blood appears, being due in half to direct injury to the mucous membrane and in the other half to the initial stage of a foreign body ureteritis." Willy Meyer says, "A certain amount of blood in the urine is the rule." All writers of experience agree that a certain amount of blood in the urine must be disregarded.

In addition to the blood, epithelial cells from the ureter are found in the urine. Holscher says (*loc. cit.*), "In all cases the urine contains a large amount of epithelial cells, scraped from the ureters by the catheter, to which no diagnostic importance can be attached." In view of the common presence of blood

and epithelial cells in the urine, due to the trauma incident to the introduction of the catheter, he says, "No conclusions could be drawn of an affection of the ureter or kidney."

Disarding the urine that first collects does not insure blood-free urine, as I have known blood to still show after the catheter had been left in place several hours. Nor is it possible to escape the blood by passing the catheter still farther up the ureter, as has been advised. One of the most important points to be learned from collecting the urines separately from the kidneys is the "functional capacity" of the probably healthy organ. In order to estimate this with approximate accuracy, it is necessary to collect all of the urine secreted by the organ in a given time. It has been observed that all of the urine does not pass through the ureteral catheter, but some of it is carried past the instrument by the peristaltic action of the ureter and emptied into the bladder. Willy Meyer says (*loc. cit.*), "I have distinctly seen jets of urine at the ureteral opening enter the bladder with the ureteral catheter *in situ*. The urine evidently often drains alongside the catheter besides passing through its lumen." Holscher (*loc. cit.*) says the presence of the catheter in the ureter may cause a reflex anuria, and cites a case in which the urine flowed for five minutes from each ureter, then stopped, and not a drop came for forty minutes. These facts make it necessary to accept with caution the estimate of the "functional capacity" based upon the amount of urine that flows through the catheter in a given time.

In addition to the obstacles and sources of error above mentioned, associated with ureteral catheterization, there is one other point that needs consideration, namely, its dangers. The chief danger consists in the carrying of infection to an ureter or kidney which is healthy. However slight this danger may be made to appear, all writers on the subject, without exception, acknowledge it as a possibility, and since the possibility, in more than one instance, has become an actual fact, the necessity of restricting the use of the procedure in certain cases has been recognized. Casper says (*loc. cit.*), "I advocate the greatest possible precaution and care in practising this

method, as in every case the possibility of an infection must be conceded." To indicate how strongly he is impressed with the danger of infecting the ureter, he recommends irrigating the ureter with a solution of nitrate of silver after catheterization. Israel (*Verhandlung der Berliner medicinische Gesellschaft*, 1899, S. 16) mentioned two cases of infection of the kidney; and, although this statement brought on a heated discussion between him and Casper, I think one who follows out the arguments in full must admit that, so far as this point is concerned, Israel maintained his claim. Hollander (*Berliner klinische Wochenschrift*, 1897, Vol. xxxiv, p. 740) mentions a case of right-sided kidney tuberculosis with previous healthy bladder in which, after catheterization of the ureter, a tubercular ulcer developed on the ureter papilla. Denos (*Soc. Fran. d'Urologie*, October, 1898) reports four cases of infection following ureteral catheterization, one of which ended fatally on the third day. Wagner says (*Handbuch der Therapie Innerer Krankh.*, Vol. vii, S. 263), "In the presence of cystitis in spite of the most careful irrigation of the bladder, still, infection of the healthy ureter and kidney by means of ureteral catheterization can easily take place. One must therefore, in cases of cystitis, also in bladder and one-sided kidney tuberculosis, limit ureteral catheterization as much as possible, and must, under these conditions, catheterize an ureter from which clear urine flows, only under the most urgent reasons." Posner (*Verhandlung der Berliner medicinische Gesellschaft*, 1899) says, "Tuberculosis of the bladder is an absolute contraindication to catheterization of the ureter." Imbert (*Ann. d. Mal. d. Org. Gen. Urin.*, 1898, Vol. xvi, p. 715) says, "If the bladder is infected while the kidney is still healthy, one should decide on catheterizing the ureter only with the greatest circumspection." Winter says (*Zeitschrift für Geburtshilfe und Gynäkologie*, 1897, Vol. xxvi, p. 497), "The indications for catheterization of the ureters must naturally be drawn much closer than for cystoscopy, because the procedure occasionally, namely, in diseased bladders, can lead to infection of the ureter and kidney pelvis."

The danger of infecting a healthy kidney, when the bladder is already septic, is recognized as so great that the method is condemned in this class of cases except under the most urgent necessity. But it is in this class of cases that it is so desirable to know to what extent, if any, the kidneys are already involved, and, as is well known, one is unable to tell the origin of pathologic products by their mere presence in the urine. Casper (*loc. cit.*) says on this point: "The quantity of pus, of albumen, or their relations to each other; the reaction of the urine; the form of the epithelial cells, and the so-called 'Pfröpfe,' give us absolutely no support for diagnosis," as they may all be just the same in cystitis or pyelitis. It is often impossible to accurately differentiate between these two conditions without collecting the urines directly from the kidneys; consequently, in this class of cases many patients will be submitted to the danger of infecting a normal kidney from an infected bladder if the ureteral catheter be used.

Turning now to the urine segregator, we find the conditions essential to its use are much the same as those for the cystoscope. Thus, the urethra must be of sufficient size to permit the introduction of the instrument, which is equivalent to No. 24 of the French scale. The bladder must be large enough to allow the instrument to be opened within it. This may be expressed by a capacity of about 150 cubic centimetres. As the sense of sight is not used to locate the ureteral orifices, the third condition mentioned under the use of the cystoscope, namely, transparency of the fluid used, does not apply to the use of the segregator. Conditions within the bladder, such as folds of mucous membrane, etc., which rarely make it impossible to locate the ureteral orifice and introduce the catheter, would not interfere with the use of the segregator. Large fungous growths that bleed profusely on touch may prevent the use of the instrument, but the same will usually interfere with catheterization as well. Small growths need not interfere with the successful use of the segregator. In hypertrophy of the prostate, where the enlargement is unilateral, so as to distort the base of the bladder; where the trigone is so thickened that

it cannot be elevated to form a septum, or where a so-called middle lobe projects into the bladder, the segregator can seldom be satisfactorily used, while, perhaps, in the most of these cases the ureter can be catheterized. In that condition, however, of pouching of the base of the bladder above a prostatic obstruction, such as Brown (*loc. cit.*) describes, in which he was unable to enter the ureter with any instrument, I would expect the segregator to overcome the difficulty, although I have not had an opportunity to try it in just such a case. Conditions external to the bladder which displace and distort that organ may interfere with the segregator as well as with catheterization.

Let us consider now the clinical results obtained by the use of the segregator when used in cases properly within its scope. The first point which presents itself for discussion is the septum. Can this be relied upon to accurately divide the urines so there shall be no intermixture of the urine from one side with that from the other? The reliability of the septum may be demonstrated in three ways:

(1) The use of the instrument in cases where but one kidney is known to be present, as, for instance, after one kidney has been removed by operation.

(2) In simple uncomplicated unilateral renal hæmaturia, and

(3) Where the findings have been proven by operation or autopsy.

Cases of the first class are of value for the purpose of demonstration for the reason that the appearance of any urine whatever in the vial on the side corresponding to the one from which the kidney had been removed would show at once, anomalies excluded, that the septum was not perfect. I have demonstrated the reliability of the septum in such cases in both the male and female. Cases of the second class form beautiful demonstrations. The contamination of the normal, clear urine from one side by the slightest amount of the bloody urine from the opposite side would become at once apparent. I have examined two such cases: One a young man, aged

thirty, in the practice of Dr. McArthur, and the other a man about thirty-five years old, in the practice of Dr. Hooper. In both of these cases the bleeding, which was very profuse, came from the left kidney. The urine from the right side was normal, perfectly clear, and free from blood. A beautiful demonstration in each of these cases of the efficiency of the septum. Of the third class, I have had numerous cases. A few illustrative cases will be mentioned.

Mrs. P., aged forty, examined for Drs. Watkins and Danforth. She had had a vesico-vaginal fistula made some time previous to drain an inflamed bladder. Pyonephrosis of the right side was then diagnosed and a large pus sac drained through the loin. A urinary fistula persisted in the loin, and the examination was made to determine how much, if any, urine from the right kidney came by way of the bladder. The examination showed clear, normal urine from the left kidney, and none whatever from the right. At the operation which followed, the right ureter was found impervious.

I examined for Dr. F. Henrotin a woman who presented a small tumor in the right side of the abdomen just below the costal arch, the exact nature of which appeared doubtful. The left kidney furnished clear, normal urine, while none whatever came from the right side. The tumor was, therefore, referred to the kidney. At the operation, a pyonephrosis was found, with a large calculus completely occluding the ureter at its upper end.

Mrs. L., aged thirty-nine, had been operated on three years before, and a stone weighing 120 grains removed from the left kidney. A discharging fistula remained. Two or three attempts had been made to induce the fistula to close by operation, but unsuccessfully. She then came under my care, and by the segregator were collected in twenty minutes twenty-seven cubic centimetres of clear acid urine from the right kidney and none from the left. At the operation, all that remained of the left kidney were several abscesses, with much tubercular granulations and old cicatricial tissue. Small masses of tuberculous kidney tissue were found embedded in the general mass, all of which was with great difficulty removed.

Mrs. B., aged forty-three, presented a tumor in the right side of abdomen which had given her trouble for some years, but

which had become much worse during the past three weeks. With the segregator, clear, normal urine was obtained from the left side, and absolutely none from the right. At the operation I removed a tuberculous kidney containing multiple abscesses and a large dilated pelvis forming a large pus sac. The ureteral opening at the pelvis was entirely occluded, so that nothing passed along this canal.

Mr. H., aged thirty-seven; presented a tumor in the right side of the abdomen which had given him trouble for about three years. History of vesical irritation, pyuria, pain, etc. Recently the trouble had much increased following an acute gonorrhoeal infection. Tumor had enlarged considerably, and fever, chills, and emaciation were prominent features. With the segregator in twenty minutes there were obtained fourteen cubic centimetres of clear acid urine, containing 2.3 per cent. of urea and a trace of albumen from the left kidney. No urine whatever from the right side. At the operation I removed a tuberculous kidney containing multiple abscesses, and surrounded by large perinephritic abscesses. The kidney, as a secreting organ, was practically destroyed, and there was no open communication with the ureter.

• In all of these cases an operation demonstrated absolutely the correctness of the results as obtained by the use of the segregator. They likewise prove the reliability of the septum, for, had the smallest amount of urine passed over the septum, it would have appeared at once in the vial corresponding to the diseased kidney, which the operation showed in each case was furnishing no urine. It is not denied that it is possible for the urines to intermix during the use of this instrument, but when this occurs, it is due to a disregard of simple instructions. It may occur by adjusting the instrument so that the septum is raised too high and too far away from the catheters, or from pushing the instrument too far in the bladder. This is always the result of gross carelessness, as each instrument is indelibly marked exactly where the clamps should be placed fixing the lever, and any deviation from this is inexcusable. Intermixture may also occur if the shoulders or body of the patient be raised so that the base of the bladder slopes towards the internal orifice of the urethra. The hips should always be as

high, or even a little higher than the shoulders, so that the slope of the base of the bladder is towards the fundus, and the instrument should always be held so as to slope from within gently upward and outward. It will be seen that these rules are very simple, and, if followed, no intermixture of the urines will take place.

The next question for consideration is: Does the urine as collected in the vials represent accurately the urine as it leaves the ureters, or may it become contaminated by pathologic products formed within the bladder? Upon the answer to this question depends the value of the instrument in differentiating renal from vesical disease. As is well known, it is often impossible to decide, without collecting the urines directly from the kidneys, the exact point of origin of the pathologic elements found in the urine. In all cases where this point is at issue, the bladder should be properly prepared before examination. Recognizing the impossibility of removing absolutely every particle of pus from an inflamed bladder wall by irrigation, I maintain that this can be done thoroughly enough for practical purposes. I use for irrigating a slightly alkaline, normal salt solution. The catheter used should be as large as can conveniently be introduced in order that the flow in and out may be as rapid as possible. This prevents sedimentation of particles detached by the ingoing fluid before they can escape with the outgoing fluid. It is of the greatest importance, in cleansing a bladder for this purpose, to irrigate thoroughly the posterior urethra. I have repeatedly irrigated the bladder until the last drop of returning fluid was perfectly clear, and then found the posterior urethra still filled with pus. In men the prostate should be massaged during the irrigation, so that the subsequent introduction of the lever may not press out any pus to find its way into the bladder. With these simple precautions, the bladder can be so cleansed as not to contaminate the urine in its passage from the ureteral opening to the catheter. Besides, it should be remembered that the urine comes in contact with but an extremely small portion of the bladder wall, and but for an exceedingly short interval of time, passing

almost instantly from the ureter into the catheter. A few illustrative cases are given in support of these statements:

Mr. D., aged thirty-three. Trouble began about four years since with frequent urination and pyuria. General health failed greatly. About one year since an abscess was opened in the right lumbar region. A fistula discharging pus and some urine persisted at this point. At the time of examination, he was passing urine containing considerable pus every few minutes day and night. With the segregator there were obtained in thirty minutes fifteen cubic centimetres of cloudy urine, containing considerable pus and albumen from the right kidney and twenty-five cubic centimetres of clear, light yellow urine, free from albumen and pus, from the left kidney. Right nephrectomy was performed, and the patient recovered. The trouble was a tubercular pyelonephritis.

In the case of Mr. H., already mentioned, nephrectomy for tubercnlosis of right kidney, the urine at the time of examination contained a large amount of pus. Notwithstanding this fact, we obtained perfectly clear urine from the left kidney, free from pus. It will be remembered no urine whatever came from the right kidney. Therefore the pus present in the voided urine must have been of vesical origin. Another proof that all the pus in the case of Mr. H., and part of it in the case of Mr. D., was of vesical origin is the fact that after the removal of the kidney the pus in the urine still continued, although both of them soon recovered from their cystitis.

I recently examined for Dr. H. B. Favill, Mr. W., an elderly gentleman, who had constantly some pus in the urine with albumen and casts and, occasionally, some blood. There had been pain in the back, and the presence of a renal calculus seemed probable. With the segregator, we found the urine from both sides free from pus. Both urines contained albumen. That from the left side contained only 1 per cent. of urea, about half as much as the right, and a few hyaline casts. That from the right side contained 1.85 per cent. of urea, more albumen than the left, and numerous granular and a few epithelial casts. Tubes inoculated with these urines remained sterile. The pus was of vesical origin, and our diagnosis double chronic nephritis, the process being in different stages on the two sides with mild cystitis.

Another very interesting case recently examined was that of Mr. C., aged thirty-eight. He had been troubled for about six months with frequent urination, a light irregular fever, and a gradual loss of strength and general health. With the segregator we found that the urine from each side contained a small amount of pus, and numerous epithelial cells, similar to those lining the renal pelvis. There were no casts, but albumen, corresponding to the pus, was present. Inoculations from both urines developed a pure culture of the colon bacillus. We had here, therefore, a double pyelitis, due to an infection with the colon bacillus.

These cases demonstrate that the instrument may be successfully used to differentiate between vesical and renal diseases.

In speaking of ureteral catheterization, it will be remembered it was stated that in about 50 per cent. of the cases slight hæmorrhage was produced by the introduction of the catheter, and a small amount of blood appeared in the collected specimen. The same may be said of the segregator, that it may excite hæmorrhage from the bladder wall, thus contaminating the urines. And this cannot be denied. It is the exception, however, for this to occur when the bladder is healthy, but it is not uncommon for a little blood to appear in the urines when the bladder is irritable or inflamed. This will give rise to no confusion either in the use of the segregator or the ureteral catheter when the urine voided naturally by the patient is free from blood, as it is then very evident that the blood is due to the trauma of the examination. When, however, a small amount of blood is present in the voided urine and it is desired to learn its source, much confusion may result, and a definite conclusion at times is impossible, although an experienced observer will often be able to differentiate between the fresh blood from the bladder wall and that which has been slowly exuded in the kidney, if examined immediately. In those cases in which the bladder is inflamed, and the use of the instrument liable to cause bleeding, I have found the use of a fresh solution of suprarenal extract of great value. The peculiar property of this substance of contracting the blood-vessels

when applied locally to a mucous membrane, thus rendering it almost bloodless, is well known. I introduce from fifty to sixty cubic centimetres of a freshly prepared 5-per-cent. solution into the bladder and allow it to remain from ten to fifteen minutes. This is washed out, and followed by fifteen to twenty cubic centimetres of a 2-per-cent. solution of cocaine, which is allowed to remain about six minutes. A bladder thus treated will stand considerable manipulation without bleeding, and does much towards eliminating the question of hæmorrhage from this organ in these cases, so far as the segregator is concerned. The suprarenal extract, by rendering the bladder wall so anæmic, also diminishes temporarily any secretion there may be from an inflamed mucosa which might contaminate the urines.

An advantage of the segregator is that all of the urine which escapes from the ureters is collected in the vials. None of it is lost. With the ureteral catheter, while the most of it undoubtedly passes through the catheter, some of it may pass around it and thus be lost. While, so far as qualitative analysis goes, this is of no importance, it may be of considerable importance when it is desired to estimate the "functional capacity" of a kidney. Another decided advantage of the segregator is its freedom from the danger of infecting the kidneys. However much we may attempt to minimize this danger with the ureteral catheter, its existence must be acknowledged by all, and it is so great that in certain infections of the bladder its use is interdicted entirely. The segregator may be safely used in these cases without any danger of infecting the kidneys.

It is not intended to convey the idea that the segregator can be used successfully in all cases. I have failed completely in a case of fungous growth of the bladder; in vesical calculi; in some cases of prostatic enlargement; in a case of a large tuberculous nodule occupying one side of the prostate; where the bladder was too much contracted to permit the turning of the instrument; in a case of tuberculous ulceration of the bladder where the introduction of the instrument excited so

much spasm of the bladder that it could not be tolerated, although this last case was before I knew how to anæsthetize the bladder, and the spasm could have been overcome by local or general anæsthesia. I now usually make use of local anæsthesia after the following manner: The bowel is washed out and the following mixture introduced: Antipyrin, one gramme; Tr. Opii, one cubic centimetre; Water, ninety cubic centimetres. This requires about thirty minutes to act, and renders the base of the bladder quite anæsthetic. While waiting for it to act, the bladder is irrigated, and the solutions of suprarenal extract and cocaine used as above described. After this preparatory treatment, the instrument may be used with almost no sense of pain even when the bladder is quite sensitive. Great caution must always be exercised in the use of cocaine in a bladder that is ulcerated or denuded of mucous membrane, as serious toxic symptoms may result.

Many of the critics of the segregator seem to have been imbued with the idea that it was intended to take the place of every other device and method of examination in the diagnosis of diseases of the urinary tract. It has been criticised as unreliable because it would not diagnose an ulcer of the bladder; because with it one could not see a small papilloma or epithelioma of the bladder wall; because it could not be used in certain cases which had already been shown were unsuited to its use; because with it one could not tell the exact point at which a stone was lodged in the ureter, etc.

The segregator is not a cystoscope, nor does it in any way take the place of one. The cystoscope is just as necessary and as useful as ever; but with the cystoscope one cannot collect the urines directly from the kidneys, while with the segregator one can. The use of the one instrument thus often supplements that of the other. The collecting of the urines directly from the kidneys does not make a diagnosis. It but adds one more fact which must be judiciously weighed with all others. In summing up then, we find: That catheterization of the ureters has a field of application which is absolutely distinct, in the sense that no other means at our disposal accomplishes

the same end, namely, to determine the nature and location of obstructions of the ureter; to locate the ends of a divided ureter or as a guide in certain intrapelvic operations; for tapping and draining fluid accumulations in the renal pelvis; for therapeutic purposes, such as dislodgement of calculi, irrigation of renal pelvis, etc.

Catheterization of the ureters simply for the purpose of collecting urine for diagnostic purposes has its drawbacks and limitations, among which may be mentioned temporary anuria, due to the presence of the catheter in the ureter; contamination of the urine with blood and epithelial cells from the ureter; danger of infecting a healthy ureter and kidney. This last-mentioned point is of such a serious nature that catheterization of a healthy ureter, when the bladder is infected, or the opposite kidney tuberculous, has been condemned. If this injunction be heeded, as it should be, it will deny the benefits of this diagnostic aid to a large class of patients.

We find that the segregator likewise has its limitations. There are certain cases above mentioned which are not suited to its use. In certain intravesical lesions its use must be supplemental to that of the cystoscope. But for the differential diagnosis of certain tumors of the abdomen; for determining which kidney is diseased and the "functional capacity" of each, whether the bladder be infected or not; for differentiating between certain bladder and kidney infections, the segregator gives results that are perfectly reliable, as has been repeatedly demonstrated by numerous anatomic findings. Furthermore, in the infected cases it has the advantage over the ureteral catheter of being free from the danger of infecting a healthy kidney.